

## **E-3 AIRBORNE WARNING AND CONTROL SYSTEM (AWACS)**



The E-3 AWACS is a commercial Boeing 707-320C airframe modified with an AN/APY-1 or AN/APY-2 radar. It is also equipped with general and specialized mission computers, multi-purpose displays, and clear and secure multiple-voice and data link communications. The United States has a total of 33 E-3s, assigned to Pacific Air Forces and Air Combat Command. AWACS has been employed in support of joint and multinational operations around the world. NATO, Great Britain, France, and Saudi Arabia also operate variants of the E-3. Finally, Japan operates a variant of the E-3 installed on a 767.

The Air Force is currently studying what upgrades to include in the next major AWACS modification, Block 40/45. This upgrade centers on replacing the current mission computer and the operators' terminals, with a COTS computer and a network of operator workstations. All software will be rewritten according to current standard business practices. This upgrade will enable the Air Force to incorporate several necessary improvements to AWACS functionality including multi-source integration (MSI), increased electronic support measures (ESM) system memory, integration of the Intelligence Broadcast System (IBS), and data link infrastructure (DLI). These improvements will be achieved by new tracking algorithms, software control of the communications subsystem, improved human-machine interfaces, and improved data link latency. The Block upgrade supports continued improvements to E-3 information correlation functions that will enable the E-3 to support SIAP and will extend AWACS capabilities through the 2025-2035 timeframe.

### **BACKGROUND INFORMATION**

Since initial fielding, the U.S. E-3 AWACS has undergone nearly continuous modification. The most recent prior to Radar System Improvement Program (RSIP) was the Block 30/35 upgrade, which included significant improvements in navigation, communication, central mission computer, and electronic support measures (ESM) capabilities.

RSIP replaced the aging AWACS radar sub-system computer, the Airborne Radar Technician workstation, other selected radar system hardware and software, to improve pulse-Doppler radar sensitivity and resistance to electronic countermeasures. RSIP also increased reliability and maintainability of the modified components, including increased radar sensitivity.

Block 40/45 will replace the aging AWACS computer system, and the operator's terminals with a network of commercial-off-the-shelf (COTS) operator workstations linked to several UNIX-based COTS computers. This configuration will be connected by a Gigabit Ethernet LAN and adds digital communications both for control of the radios and for internal communications. The baseline for the Block 40/45 upgrade will be the NATO Mid-Term Upgrade. Block 40/45 will improve E-3 reliability and availability, providing theater commanders significantly enhanced surveillance and control capabilities while contributing to information superiority needed to control the battlespace.

### **TEST & EVALUATION ACTIVITY**

The USAF is currently scoping the Block 40/45 development effort, including the development of a TEMP. DOT&E is participating in this process and is sharing lessons learned from the Navy's E2C multi-system upgrade that included Cooperative Engagement Capability. Block 40/45 testing will combine developmental and operational tests. Test data from NATO and U.K. tests/exercises will be used to reduce test costs and duration. In addition to leveraging existing activities wherever practical, modeling and simulation will be employed to evaluate maturity and maximum capacity of some of the Block 40/45 components. The USAF has been using modeling and simulation to interface with operators to get their comments on performance as part of the pre-EMD risk reduction activities. The Block 40/45 development and test employs the "spiral" approach.

### **TEST & EVALUATION ASSESSMENT**

Re-hosted radar software led to problems during the RSIP program. The problems were due to inadequate protection of aircraft radar hardware under certain operating conditions and degrading the long-range detection and tracking performance of the Beyond-The-Horizon radar. Both those issues have been corrected and steps were taken in both the ground and air test procedures to prevent recurrences. However, numerous in-flight failures of software routines resulted in low Mean Time Between Failure and remains a concern for RSIP. The Block 40/45 program will require re-hosting significantly more software. DOT&E will advise the 40/45 program to prevent a repeat of the types of problems experienced with the RSIP program.